

# GPS Celestial Navigation

## Latitude Calculation Work Sheet

NAME \_\_\_\_\_

DATE \_\_\_\_\_

rev 6

|  |   | Our School                          | Their School                        |
|--|---|-------------------------------------|-------------------------------------|
| Measurement Data<br><br>(Intermediate)<br>(Advanced) | Our Latitude                            | <input type="text"/> [Degrees]      | We are going to<br>compute theirs   |
|  | Our Longitude                           | <input type="text"/> [Degrees]      |                                     |
|  | Universal Time of Minimum Shadow Length | <input type="text"/> [HH:MM]        | <input type="text"/> [HH:MM]        |
|  | Length of Shadow at Minimum Length Time | <input type="text"/> [mm]           | <input type="text"/> [mm]           |
|  | Sun Angle at Minimum Length Time        | <input type="text"/> [Degrees]      | <input type="text"/> [Degrees]      |
|  | Height of Pole                          | <input type="text"/> [mm]           | <input type="text"/> [mm]           |
|  | Direction of Pole's Shadow              | <input type="text"/> North or South | <input type="text"/> North or South |

### Compute Sun Angle

Computed Sun Angle =  $\arctan(\text{Pole Height[mm]} / \text{Shadow Length[mm]})$

(Advanced Only)

Computed Sun Angle =  [Degrees]  [Degrees]

Advanced students should use the computed Sun Angle throughout computations

### Compute Zenith Angle

This is the angle at the top of the triangle.

If the sun were over the equator when you made your measurements, then the Zenith Angle would be your latitude.

Zenith Angle =  $90 [\text{degrees}] - \text{Sun Angle} [\text{degrees}]$

Our Zenith Angle  [Degrees]      Their Zenith Angle  [Degrees]

### Compute Latitude Difference

Because both Sun Angle measurements are made on the same day regardless of the sun's location, the difference in Zenith Angles gives us latitude change between schools.

[degrees] = Latitude Change =  [degrees] + / -  [degrees]

(If a negative result, keep only the positive magnitude)

If shadows point in different directions +  
If shadows point in same direction -

### Compute Their Latitude

[degrees] = Their Latitude =  [degrees] + / -  [degrees]

Different shadow directions -  
Same shadow directions and:  
Our sun angle is smaller -  
Their sun angle is smaller +

### Corrected Latitude

Their Latitude =  [degrees] North or South (circle one)

If negative, then their school is in your opposite hemisphere